Attorney's Docket No. American P-302 PCT

CHAPTER II

TRANSMITTAL LETTER TO THE UNITED STATES ELECTED OFFICE (EO/US)

25686
PATENT TRADEMARK OFFICE

(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US99/24800	22.10.99	23.10.98

TITLE OF INVENTION
"WATER CONDENSATION SYSTEM"

APPLICANT(S)
William S. Malson, et al.

Box PCT
Assistant Commissioner for Patents
Washington D.C. 20231

ATTENTION: EO/US

NOTE: The completion of those filing requirements that can be made at a time later than 30 months from the priority date results from the Commissioner exercising his judgment under the authority granted under 35 USC 371(d). The filing receipt will show the actual date of receipt of the last item completing the entry into the national phase. See 37 CFR 1.491 which states: "An international application enters the national state when the applicant has filed the documents and fees required by 35 USC 371(c) within the periods set forth in § 1.494 and § 1.495."

***WARNING:** Where the items are those which can be submitted to complete the entry of the international application into the national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 CFR 1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing - 37 CFR 1.8 (2) (xi)).*

NOTE: Documents and fees must be clearly identified as a submission to enter the national state under 35 USC 371 otherwise the submission will be considered as being made under 35 USC 111. 37 CFR 1.494(f).

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this Transmittal Letter and the papers indicated as being transmitted therewith is being deposited with the United States Postal Service on this date April 23, 2001, in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number ET096801561US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Nancy L. Craft
(type or print name of person mailing paper)

Nancy L. Craft
Signature of person mailing paper

NOTE: Each paper or fee referred to as enclosed herein has the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 CFR 1.16(b).

***WARNING:** Certificate of mailing (first class) or facsimile transmission procedures of 37 CFR 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.*

I. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. 371:

a. ☒ This express request to immediately begin national examination procedures (35 U.S.C. 371(f)).

b. ☒ The U.S. National Fee (35 U.S.C. 371(c)(1)) and other fees (37 CFR 1.492) as indicated below:

2. Fees

CLAIMS FEE	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
☒*	TOTAL CLAIMS	15 -20=	0	$18.00 × ~~$22.00~~	$ 0.00
	INDEPENDENT CLAIMS	2 -3=	0	$80.00 × ~~$78.00~~	0.00
	MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ ~~$250.00~~ $270.00	
BASIC FEE**	☒ U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where an International preliminary examination fee as set forth in § 1.482 has been paid on the international application to the U.S. PTO: ☒ and the international preliminary examination report states that the criteria of novelty, inventive step (non-obviousness) and industrial activity, as defined in PCT Article 33(1) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 CFR 1.492(a)(4)) ..... $100.00 ☐ and the above requirements are not met (37 CFR 1.492(a)(1)) ..... $690.00 ☐ U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO: ☐ has been paid (37 CFR 1.492(a)(2)) ..... $710.00 ☐ has not been paid (37 CFR 1.492(a)(3)) ...$1,000.00 ☐ where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 CFR 1.492(a)(5)) $860.00				$690.00
	Total of above Calculations				= $690.00
SMALL ENTITY	Reduction by 1/2 for filing by small entity, if applicable. Affidavit must be filed also. (note 37 CFR 1.9, 1.27, 1.28)				- 345.00
	Subtotal				$ 345.--
	Total National Fee				$ 345.00
	Fee for recording the enclosed assignment document $40.00 (37 CFR 1.21(h)). (See Item 13 below). See attached "ASSIGNMENT COVER SHEET".				
TOTAL	Total Fees enclosed				$

*See attached Preliminary Amendment Reducing the Number of Claims.

i. ☒ A check in the amount of $986.00 to cover the above fees is enclosed.

ii. ☒ Please credit Account No. 03-0682 with any overpayment. A duplicate copy of this sheet is enclosed.

***WARNING:** *"To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: * * * (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended." 37 CFR § 1.495(b).*

WARNING: *If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 CFR § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of January 3, 1993, 1147 O.G. 29 to 40.*

3. ☒ A copy of the International application as filed (35 U.S.C. 371(c)(2)):

NOTE: Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment. "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of January 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.

a. ☐ is transmitted herewith.

b. ☒ is not required, as the application was filed with the United States Receiving Office.

c. ☐ has been transmitted

i. ☐ by the International Bureau.
Date of mailing of the application (from form PCT/1B/308): _____.

ii. ☐ by applicant on (date) _____.

4. ☒ A translation of the International application into the English language (35 U.S.C. 371(c)(2)):

a. ☐ is transmitted herewith.

b. ☒ is not required as the application was filed in English.

c. ☐ was previously transmitted by applicant on (*date*) _____.

d. ☐ will follow.

5. ☒ Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. 371(c)(3)):

NOTE: *The Notice of January 7, 1993 points out that 37 CFR § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1.121. In many cases, filing an amendment under section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 36.*

a. ☐ are transmitted herewith.

b. ☒ have been transmitted

i. ☒ by the International Bureau.
Date of mailing of the amendment (from form PCT/1B/308): 04.05.00.

ii. ☐ by applicant on (date) _____.

c. ☐ have not been transmitted as

i. ☐ applicant chose not to make amendments under PCT Article 19.
Date of mailing of Search Report (from form PCT/ISA/210.): _____.

ii. ☐ the time limit for the submission of amendments has not yet expired. The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.

6. ☒ A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. 371(c)(3)):

a. ☐ is transmitted herewith.

b. ☒ is not required as the amendments were made in the English language.

c. ☐ has not been transmitted for reasons indicated at point 5c above.

7. ☒ A copy of the international examination report (PCT/IPEA/409)

☐ is transmitted herewith.

☒ is not required as the application was filed with the United States Receiving Office.

8. ☒ Annex(es) to the international preliminary examination report

a. ☐ is/are transmitted herewith.

b. ☒ is/are not required as the application was filed with the United States Receiving Office.

9. ☒ A translation of the annexes to the international preliminary examination report

a. ☐ is transmitted herewith.

b. ☒ is not required as the annexes are in the English language.

10. ☒ An oath or declaration of the inventor (35 U.S.C. 371(c)(4)) complying with 35 U.S.C. 115

    a. ☐ was previously submitted by applicant on (date) _____.

    b. ☒ is submitted herewith, and such oath or declaration

        i. ☒ is attached to the application.

        ii. ☐ identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3b or 3c and 5b; and states that they were reviewed by the inventor as required by 37 CFR 1.70.

        iii. ☐ will follow.

II. Other document(s) or information included:

11. ☒ An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):

    a. ☐ is transmitted herewith.

    b. ☒ has been transmitted by the International Bureau. Date of mailing (from form PCT/IB/308): 04.05.00

    c. ☐ is not required, as the application was searched by the United States International Searching Authority.

    d. ☐ will be transmitted promptly upon request.

    e. ☐ has been submitted by applicant on (date) _____.

12. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98:

    a. ☐ is transmitted herewith.

        Also transmitted herewith is/are:

        ☐ Form PTO-1449.

        ☐ Copies of citations listed.

    b. ☒ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. 371(c).

    c. ☐ was previously submitted by applicant on (date) _____.

13. ☐ An assignment document is transmitted herewith for recording.

    A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

_____

_____

_____

14. ☒ Applicants are a small entity.

15. ☐ Additional documents:
   a. ☐ Copy of request (PCT/RO/101)
   b. ☐ International Publication No. _____
      i. ☐ Specification, claims and drawing
      ii. ☐ Front page only
   c. ☐ Preliminary amendment (37 CFR § 1.121)
   d. ☐ Other

16. ☒ The above checked items are being transmitted
   a. ☒ before 30 months from any claimed priority date.
   b. ☐ after 30 months.

17. ☐ Certain requirements under 35 U.S.C. 371 were previously submitted by the applicant on _____, namely:

AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: *Accurately count claims, especially multiple dependant claims, to avoid unexpected high charges if extra claims are authorized.*

☒ The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. 03-0682.

☒ 37 CFR 1.492(a)(1), (2), (3), and (4) (filing fees)

WARNING: *Because failure to pay the national fee within 30 months without extension (37 CFR § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.*

☐ 37 CFR 1.492(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 CFR 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

☒ 37 CFR 1.17 (application processing fees)

WARNING: *While 37 CFR 1.17(a), (b), (c) and (d) deal with extensions of time under § 1.136(a), this authorization should be made only with the knowledge that: "Submission of the appropriate extension fee under 37 CFR 1.136(a) is to no avail unless a request or petition for extension is filed." Notice of November 5, 1985 (1060 O.G. 27).*

☐ 37 CFR 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 CFR 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 CFR 1.311(b).

NOTE: 37 CFR 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 CFR 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

☐ 37 CFR 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).

Lynn E Cargill

SIGNATURE OF ATTORNEY

Reg. No.: 31,598

Tel. No.: (810) 465-6600

Lynn E. Cargill

(type or print name of attorney)

56 Macomb Place

P.O. Address

Mt. Clemens MI 48043

WATER CONDENSATION SYSTEM

Pure water is necessary for life as we know it. However, there is an enormous difference between potable, or drinking water, and available sources of water. As anyone knows, there are essentially three types of water in the world: fresh water, salt water, and brackish water. Mankind has contaminated all three types of water so that he cannot drink it. Therefore, water purification has played a huge roll in the advancement of mankind. Geographic boundaries have become important due to the water that is contained therein. The Israeli-Arab War is largely being fought over a fresh water supply.

As a matter of fact, it has been postulated by ex-president Jimmy Carter and ex-senator Paul Simmon in their book "Tapped Out" that all the wars that will be fought in the next fifty years will be fought over fresh water supplies. Recent developments in the news show that foreign countries wish to buy fresh water from Lake Superior in Northern Michigan. Great controversies have arisen over water supplies and the ability to have fresh water. Only three percent of the world's water supply is fresh water. Salt water and brackish water need to be distilled, put through reverse osmosis or a number of other conventional methods of water purification.

Traditionally, desalination of water has included various methods, including flash distillation which uses relatively large amounts of energy, or reverse osmosis which generates a large amount of waste water discharge. There are many countries in the world that derive their entire source of water through these purification methods. Both of these methods require a lot of energy and a great deal of water. As one can imagine, flash distillation or any other kind of distillation yields a relatively low amount of water when compared to the amount of energy that is required to produce it. Salt water can be distilled and potable water can be collected, although the use of a nearly equivalent amount of oil is needed to fuel the distillation process.

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With regards to reverse osmosis, it is well known that the procedure requires a nearly four to one ratio of unpurified water to purify water. This means that a concentrated brine solution is returned to the water supply, which will forever change the ecological balance in the neighboring environment. For this reason, reverse osmosis needs to be used near a main body of water so that the waste water discharge can return to the original source at a dilution ratio which will not effect the ecology of the system. Due to this enormous amount of discharge, reverse osmosis will change the electrolytic balance of an ecology, thereby changing the structure of fishing and other wild life near the shore. Currently, reverse osmosis is used near the Red Sea, the Mediterranean Sea, and other large areas without tides. This compounds the problem because the dumping of the waste water discharge cannot be washed away with the tide and diluted.

Currently, large water purification freighters containing reverse osmosis units are placed in International Waters by various countries so that the dumping of the waste water discharge which is produced by reverse osmosis is done in an off shore place, where the laws do not require the ecological imbalance to be checked.

Naturally, different water environments exist throughout the world. These conventional water purification systems will find application throughout the world in areas where there is a large main body of water where it can dilute contaminants being ejected from the system. However, there will be many shoreline and inland applications which cannot support the large amount of contaminated discharge which is being produced by the reverse osmosis systems. These applications require some sort of distillation installation. Traditional distillation methods have included flash distillation, discussed above, in which large amounts of energy are used to take any type of water and purify it into potable water. Distillation is appropriate in shoreline and inland applications because the discharge that reverse osmosis generates will change the ecological balance as discussed above.

Distillation systems produce pure water in addition to a sludge which can be disposed of in landfills appropriately. However, distillation methods use a great deal of energy. Where the energy comes from is dependent upon the distillation system itself. Needless to say, low cost desalination is the ultimate goal of any water purification system. Another goal of water purification systems is to manage the waste which is being generated, or actually separated from, the process.

Therefore, it would be a great advantage to provide a potable water generation system which requires little non-renewable energy for carrying out its process, while as well as managing the waste which is generated therefrom in an ecologically manageable manner. It would be most advantageous if a solar distillation system having a high throughput could be available.

SUMMARY OF THE INVENTION

In accordance with the present invention there is disclosed a condensation water purification system having low energy requirements. In its most basic essence, it is a large dehumidifier for removing humidity from the air to produce pure water. This preferred embodiment includes a large dehumidifier air-to-water unit which includes a passive solar air-tight container for retaining water vapor which is produced therein through the use of solar energy and/or heat retained through solar energy, stored and then reintroduced into the condensation unit, or geothermal energy, or any other naturally occurring energy which may be put into this condensation system.

In its most basic form there is a condenser pipe contained within the water vapor container. This condenser has a refrigerated liquid, such as water, at a relatively cooler temperature than the water vapor, which causes "sweating" of the condenser pipe, much like a cold drink in a glass "sweating" on a hot day. This imitates the hydrological cyle found in nature, where rain condenses and falls down, and then evaporates again into the clouds. Another common example, this

naturally occuring phenomenon acts much like a cold drink in a glass "sweating" on a hot day. Anyone who has had a cold drink on a hot day has experienced the "sweating" which generates the purified water of this system. The present invention also generates this "sweated" water and drips it into a collection trough located under the condenser pipe which is designed to collect all the condensed water which has sweated off the condenser pipe.

This natural phenomenon is encouraged and accelerated with the present invention. It occurs on a large scale, if desired, in semi-arid to humid climates which have no ready supply of potable water. The western bank of Saudi Arabia is such a place where the humidity is generally on the order of from about 70 to about 90%, although the only water for drinking is salt or brackish water. In such semi-arid to humid locals throughout the world, there is a sufficient amount of water vapor in the air to be dehumidified and generate purified water through the present invention.

Preferably, the present invention is embodied in an elongated darkly colored air-tight container into which air is allowed with a high water vapor content. Water can be introduced into the bottom of this container, so that there is a ready supply of water vapor. Running through the length of the elongated air-tight container is a condenser pipe preferably made of copper which is located near the top of the air-tight container. A collection trough is located directly underneath the condenser pipe and is tilted to allow gravity to carry the collected water to the end of the air-tight container. Greater detail will be discussed hereinbelow. Therefore, a water purification system is disclosed which achieves the advantages of solar distillation system while taking the water directly from the air or from the environment which is created within an air-tight container.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a perspective view of the overall system in situ;

FIGURE 2 is a side elevational view of an inground embodiment of the present invention;

FIGURE 3 is a side elevational view of the core essence of the invention;

FIGURE 4 is a top view showing the inner construction of the large embodiment of the passive solar field;

FIGURE 5 is a perspective view detailing the relative placement of the condenser pipe, the collective trough, the trough collection pipe and the manifold; and

FIGURE 6 is a top plan view of the closed loop condenser pipe system utilized in the large area condensation system.

DETAILED DESCRIPTION OF THE DRAWINGS

In accordance with the present invention, FIGURE 1 shows the overall view of one embodiment of the present invention incorporating passive solar energy as the energy means input. The passive solar condensation system is shown with its many options. As can be seen, filter 54 is a water intake from the source water supply and is pumped, by pump 52, into pre-treatment retention pond 56 initially. The source water may be brackish or may contain oil or other such contaminants such that filter 54 shall initially separate out the large particulates, i.e. fish, seaweed, logs, sand and grit.

Retention pond 56 shall be used to pretreat water from the source, removing oil. or any other impurity that will contaminate the interior of the solar containbers. In the event that source water is brackish or oily, the oil can be removed partially from the water by filter 56. This water is then pumped, by pump 52, into the passive solar field 10, shown having numerous "cells" 12.

In this embodiment, each cell 12 is preferably over 200 feet long and the inside of each cell is further described herein below with respect to FIGURES 2 through 4. The clean water is collected and pumped via pump 60 into storage

tanks 75. The super salty water which is the by product of the evaporation and condensation operation is pumped into brine pond 70. Brine pond 70 will contain "clean" brine water which has a very high concentration of salt. The brine pond 70 may be used to store solar energy in the salt contained in the solution for operation drain nighttime hours when solar energy is not available. As one may realize, salt has a high thermal capacity, which is why a sandy beach is so incredibly hot to the bottom of your foot when walking on a sunny day on a beach. At nighttime, this heated, super salty water can be pumped back into the cells 12 in order to cause a greater water vapor content within cell 12 to increase the likelihood of condensation.

Still referring to FIGURE 1, there is showing an optional geothermal tank 68 which can be used to preheat the water used within cell 12 to cause greater vapor pressure, and therefore greater concentration of condensate. This geothermal option is obviously only helpful in areas where a geothermal source of heat is present.

Passive solar field 12 will essentially act as a large scale dehumidifier which will utilize 1/3 of the energy requirement of a distillation apparatus, while producing approximately two to three times of a distillery. Consequently, it is hoped that this system moves toward a low cost desalination plant, as well as a plant that does not create an ecological imbalance.

It is also recommended that warm water be "pulsed" into cell 12 so that the water has an opportunity to heat up in situ. If the water was constantly flowing, under most conditions, it would take a greater amount of thermal energy to vaporize the water within cell 12. If the intake water is "pulsed" into cell 12, enough time will be allowed between "pulses" to allow the water to vaporize within the cell.

Referring next to FIGURE 2, there is shown another embodiment of the present invention in which a plurality of the condensing tubes in a plurality of the condensing tubes are placed within a pit in the ground having a waterproof liner to

hold the liquid. A liner 11 is shown on the floor of the pit having a bottom dimension of 18 and a side wall vertical dimension of 12. Side walls 13 are held in place by side wall stakes 14. Liner 18 is shown held in place by berm 28. Liner 18 also has a liner top cover 26 to prevent evaporation into the air of the liquid within the pit. Cable 21 helps to hold down the liner top cover so that when wind creates a low pressure center it will not fly up, and another set of cables 21 are placed underneath the top in a perpendicular fashion as is more clearly shown in FIGURE 3.

The essential portions of the water condensation system includes condensers 22 which sit on top of condenser collection troughs 23. As the water "sweats" off the condenser it is collected in collection manifold 24 through trough collection pipe 25 into manifold 24. Note that manifold 24 is tipped downwardly such that the water which is collected in manifold 24 will be urged by gravity into storage tank 68. Storage tank 68 stores the "clean end " water, while sediments, such as brine or other solids are discharged through pipe 17. Water intake line 16 from the pump as shown in FIGURE 2 feeds the condensers 22 with cool water.

The cold water may be refrigerated by many different means including circulation through heat exchangers and cold ocean water, through actual refrigeration units, through reverse geothermal effects, through ice water, or any other known means for refrigerating a liquid. Furthermore, Freon may be circulated through condenser 22, as well as other known refrigerants.

It is suggested that the refrigerated liquid may be "pulsed" into condensers 22 to maximize the "sweating" of the condensers. The height adjustment of the condensers 22 are enabled by adjustable supports 19 for the cooler and the condensate lines. In this embodiment of the present invention, the passive solar field can extend over an acre in size to collect approximately 90 to 100 gallons per hour in un-optimized conditions. Unpurified water is placed in the bottom of the pit liner 18 such that as solar energy heats the cavity within, the water evaporates and creates a water vapor pressure at the top of the pit near the condensers. Chilled water was run through condenser 22 in an either continuous or pulsed

fashion to optimize sweating of condenser 22. The water is collected in condensate collection trough 23 and the trough 23 is inclined so that gravity allows the collected water to travel through trough collection pipe 25 into manifold 24 which is then, again, tipped downwardly to fall into the storage tank.

It is also envisioned that hot super-saturated brine water can be pumped out of a field in the nighttime after it has absorbed solar energy all day long. Due to the heat of this system, a water vapor concentration will be established in the top of the pit and liner and condensate will form and be collected. This invention envisions many ways of heating the water, including solar energy, salt brine heat capacity heating, geothermal heating, or any other naturally occurring for method for creating heat. The chilled water which is run through the condenser may be chilled through any means. This unit could be placed near the edge of a large body of water as shown in FIGURE 1. However, it may also be formed in a large floating farm to be placed in the middle of the ocean.

Looking now to FIGURE 3, there is shown the functioning portion of a cell in accordance with the present invention. Condenser 22 is a tube or pipe, preferably a copper plumbing pipe to aid in the sweating action, located over a trough 23 for collecting the sweated water. As discussed before, cell 12 is a water tight container holding the liquid 50 in the bottom. The sunlight comes in through the top of cell 12 and heats the liquid 50, increasing the vapor pressure in the uppermost portion of the cell. Our experiments have shown that on a 75°F day in southern Michigan, the temperature at the top of the cell was about 160°F, while the water being run through the condenser was approximately 45°F. This set of circumstances produced a optimum amount of water.

When ocean water was used as liquid 50 and Detroit City water was used as the cooled liquid going through condenser 22, and the interior temperature of the cell was 140°F, while the Detroit City water was at 40°F, 9 gallons of condensed water were made in an 18 hour period. The ocean water initially had a contamination of 30,000 PPM, and the water which was collected from sweating off the condenser pipe was produced at 8 PPM. The experimental cell was 10 feet

long, 1 foot tall and 1 foot wide. Scaling up the size of the cell only appears to create more water, not more problems.For a reference, anything less than 500 PPM is considered potable water by the World Health Organization and by EPA regulations, and anything less than 10 PPM is considered distilled by the US Distillation Association.

Still looking at FIGURE 3, it shall be noted that liquid 50 can be contaminated fresh water, salt water, brackish water, or any other liquid from which water vapor can be created. In essence, cell 12 acts as a dehumidifier when there is a high concentration of water vapor in the cell which condenses on the outside of condenser pipe 22. Other possible embodiments may include the use of a refrigerant liquid running through condenser 22, such as Freon, TFE, or other refrigerant liquids known in the art.

Referring back to FIGURE 2, liquid 50 may be a high salt content water solution which has been storing solar energy during the sunlight day hours, and may be pumped into cell 12 at nighttime in order to bring a heated aqueous solution into the cell. If liquid 50 is on the order of 120°F. and is pumped into cell 12, the water will evaporate into the air within cell 12 causing a high water vapor concentration 40. If a cooled liquid is flowed through condenser 22, water production can continue in the nighttime. As discussed above, any source of heat, whether is be from the salt, geothermal, electric, gas furnace, whatever may be utilized.

Cell 12 may be made of any dark plastic or metal in order to absorb sunlight energy. The bottom liner of cell 12 should be of a waterproof material so that liquid 50 will not leak out. Condenser pipe 22 may be made of any suitable material, such as copper pipe or aluminum pipe, or a highly thermally conductive plastic, but convention and economy dictate the used of copper piping. Trough 23 may be made of any suitable material, but is preferably made of plastics so as not to transfer any thermal energy. Insulative plastics are especially interesting. Collection trough pipe 25 and manifold 24 may be made of any suitable material, as their function is to transfer the liquid only.

Referring next to FIGURE 4, there is shown a top view of a portion of a large cell. In this embodiment, condensers 22 run longitudinally and the cell is covered by a top liner cover 26, shown in a tear-away view. Cables 21 run perpendicular to one another from underneath and on top of the cover. Condensers 22 are shown in a closed loop configuration by being connected to end pipe 30. The refrigerant coolant liquid is run through pipe 30 back to either a refrigeration unit or back down into a heat exchanger circulating in the depths of the ocean, or any other way of refrigerating that liquid. Cell 12 has side walls 13 which are held up by side wall stakes 14 and they have temperature probes 35 extending therein. The collection troughs 23 are not shown in this illustration.

Looking now to FIGURE 5, there is a perspective view of a cutaway showing the cell of FIGURE 3. Condenser 22 is shown located over collection trough 23 with brackets holding collection trough 23 underneath. More brackets hold collection trough 23 up against a board which is attached to the top of the cell. The manifold 24 for collecting the fresh water is attached to trough 23 by collection trough pipe 25. Top cover 26 is a laminated woven plastic material which is sealed around the outside of cell 12. Bottom plastic liner 61 can be made of a rigid plastic, or can be made of a soft pliable plastic being supported with rigid side walls which may be separate.

FIGURE 6 shows the closed loop configuration for the refrigerated liquid running through condensers 22 and end pipes 30. The flow of the liquid is shown entering into the system and circulating therethrough before exiting. Water enters through inlet 70 circulates through condensers 22 and end pipes 30 and exits the closed loop system through fixture 74. Block 72 prevents the flow of water except in one direction. The refrigerated liquid entered inlet 70 may be coming from any source of cool liquid.

Therefore, in accordance with the objectives and advantages described above, the above described water condensation system can supply purified, drinking water to nations where drinking water is hard to come by. With the exception of expensive reverse osmosis and distillation systems, certain regions

and nations in the world do not have sufficient money to purchase systems and operate them for purified water. This system is an inexpensive, highly effective and high capacity one in which replacement parts are few, maintenance is slight, and energy costs are minimal. The scope of the invention is to be limited only by the claims which are appended hereto.

INDUSTRIAL APPLICABILITY

The present invention finds industrial applicability in the production of water in semi-arid to humid locations where fresh water is not easily available. One of the embodiments of the present invention is designed to use solar energy to produce potable water by collecting condensate.

CLAIMS

What is claimed is:

1. A water dehumidification and condensation system, comprising:

a water vapor retaining container, wherein the container is an elongated container having dimensions of from about 6 inches in height, and from about one (1) foot to about 20 acres in width and from about two feet to about 20 acres in length;

a condenser located within the water vapor retaining container for containing a liquid at a lower temperature than the water vapor, such that condensate forms on the outside of the condenser when water vapor is present and lower temperature liquid is in the condenser; and

a collection trough under the condenser for gravitationally collecting the condensate which has sweated off the condenser thereby effecting dehumidification of the system.

2. The water dehumidification and condensation system of claim 1, wherein the water vapor retaining container is a passively heated solar system.

3. The water dehumidification and condensation system of claim 1, wherein the water vapor retaining container is airtight.

4. The water dehumidification and condensation system of claim 1, wherein the condenser is made of pipe.

5. The water dehumidification and condensation system of claim 4, wherein the condenser is made of a closed loop system of pipes.

6. The water dehumidification and condensation system of claim 4, wherein the condenser is made of a pipe material selected from the group consisting of copper and aluminum.

7. The water dehumidification and condensation system of claim 1, wherein the condenser is longitudinally oriented within an elongated water vapor retaining container.

8. The water dehumidification and condensation system of claim 1, wherein the condenser carries a liquid selected from the group consisting of water, refrigerant and supercooled gases.

9. The water dehumidification and condensation system of claim 1, wherein the liquid in the condenser is at a temperature of less than about 45°F.

10. The water dehumidification and condensation system of claim 1, wherein the container has an interior temperature of greater than about 100°F.

11. The water dehumidification and condensation system of claim 1, wherein the collection trough is of a V-shaped configuration.

12. The water dehumidification and condensation system of claim 1, wherein the condensate being collected is water having less than about 500 ppm impurities.

13. A passive solar water condensation system for processing non-potable water into potable water by condensing water vapor from contaminated water sources, comprising:

an elongated passive solar water vapor retaining dehumidification container to contain the non-potable water to be separated into potable water and residual sediment, said non-potable water to be put into a vapor phase by heating with solar energy, wherein the container is an elongated container having dimensions of from about 6 inches in height, and from about one (1) foot to about 20 acres in width and from about two feet to about 20 acres in length;

at least one condenser pipe located within the water vapor retaining dehumidification container for receiving an incoming cold liquid at a lower temperature than the water vapor, such that condensate forms on the outside of

the condenser when water vapor is present and lower temperature liquid is in the condenser; and

a collection trough under the condenser for gravitationally collecting the condensate which has sweated off the condenser, forming purified water.

14. The passive solar water condensation system of claim 13, further comprising a pre-treatment pond for pre-cleaning the non-potable water which is received by the dehumidification container.

15. The condensation system of claim 13, further comprising a storage tank for storing the purified water collected from the dehumidification process.

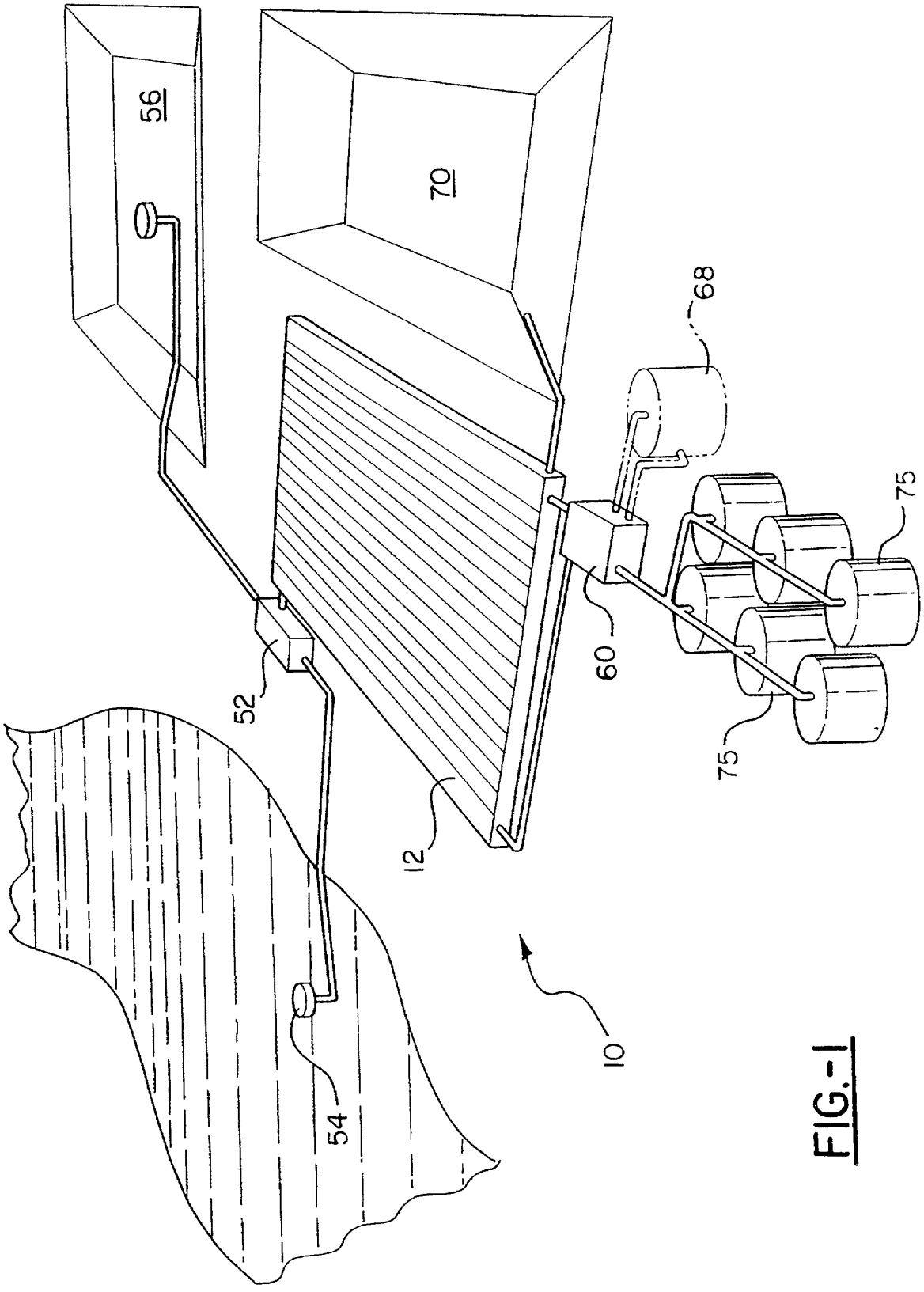

FIG.-1

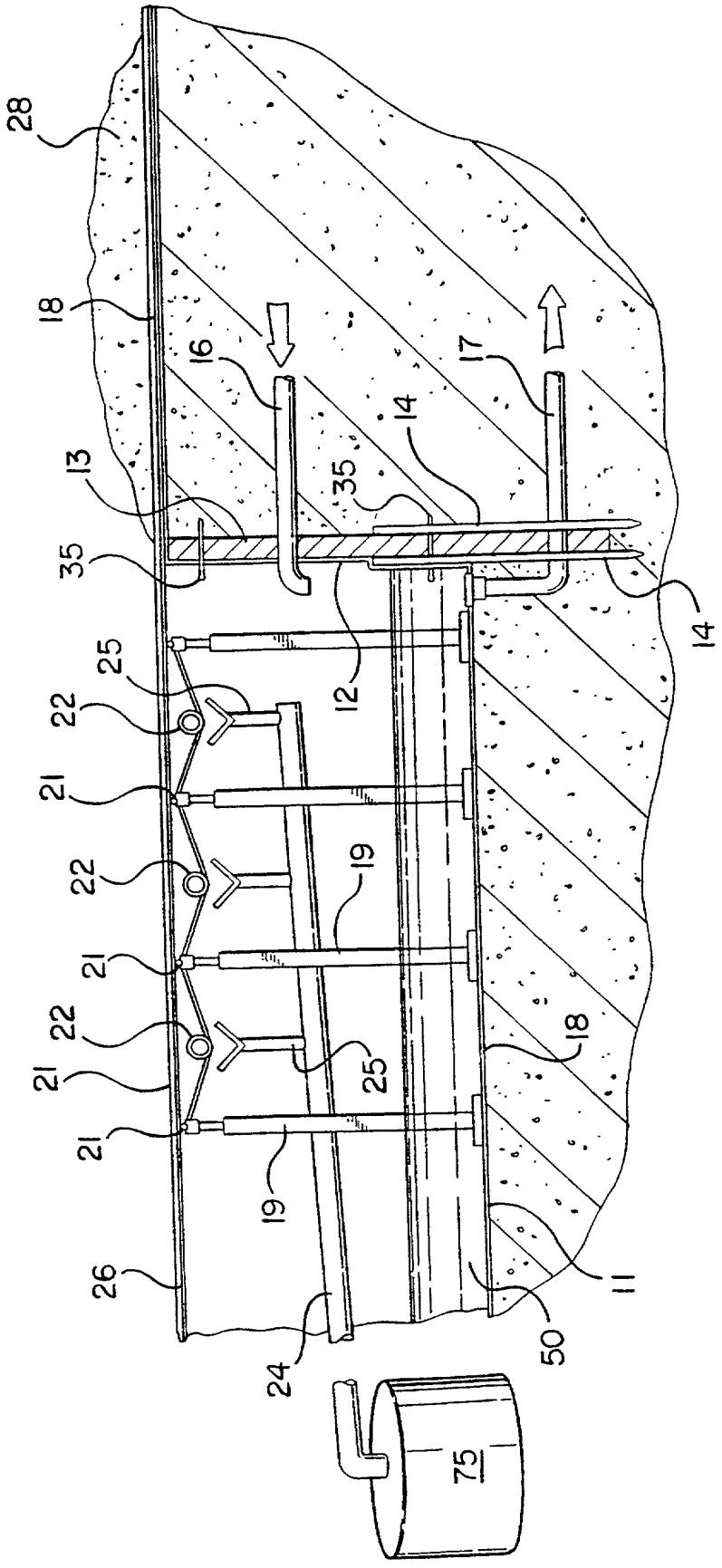
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FIG.-2

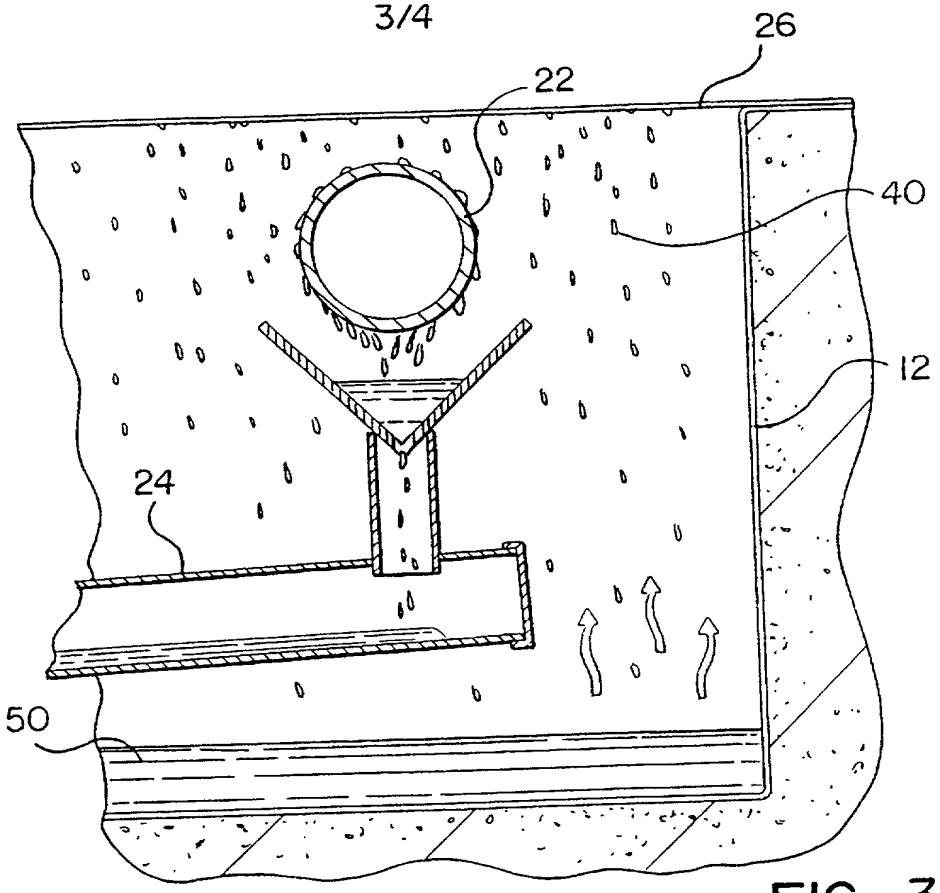
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FIG.-3

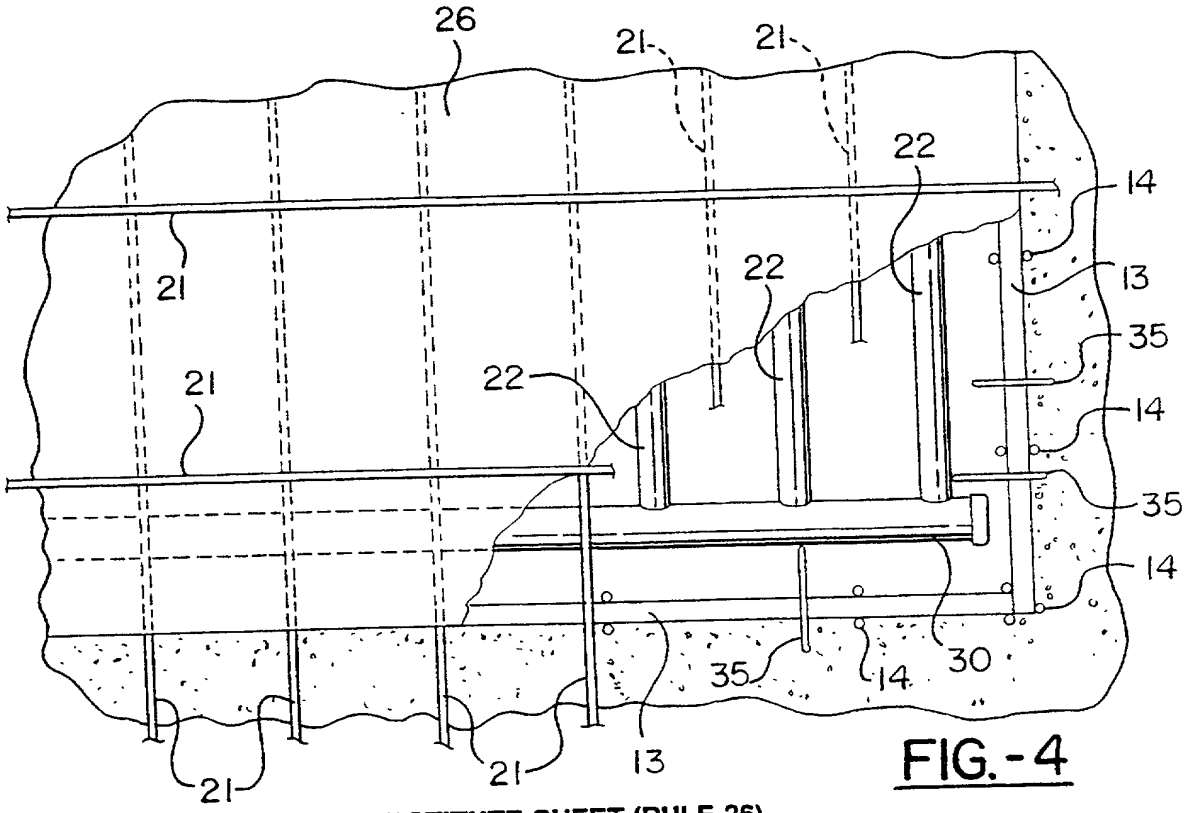
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FIG.-4

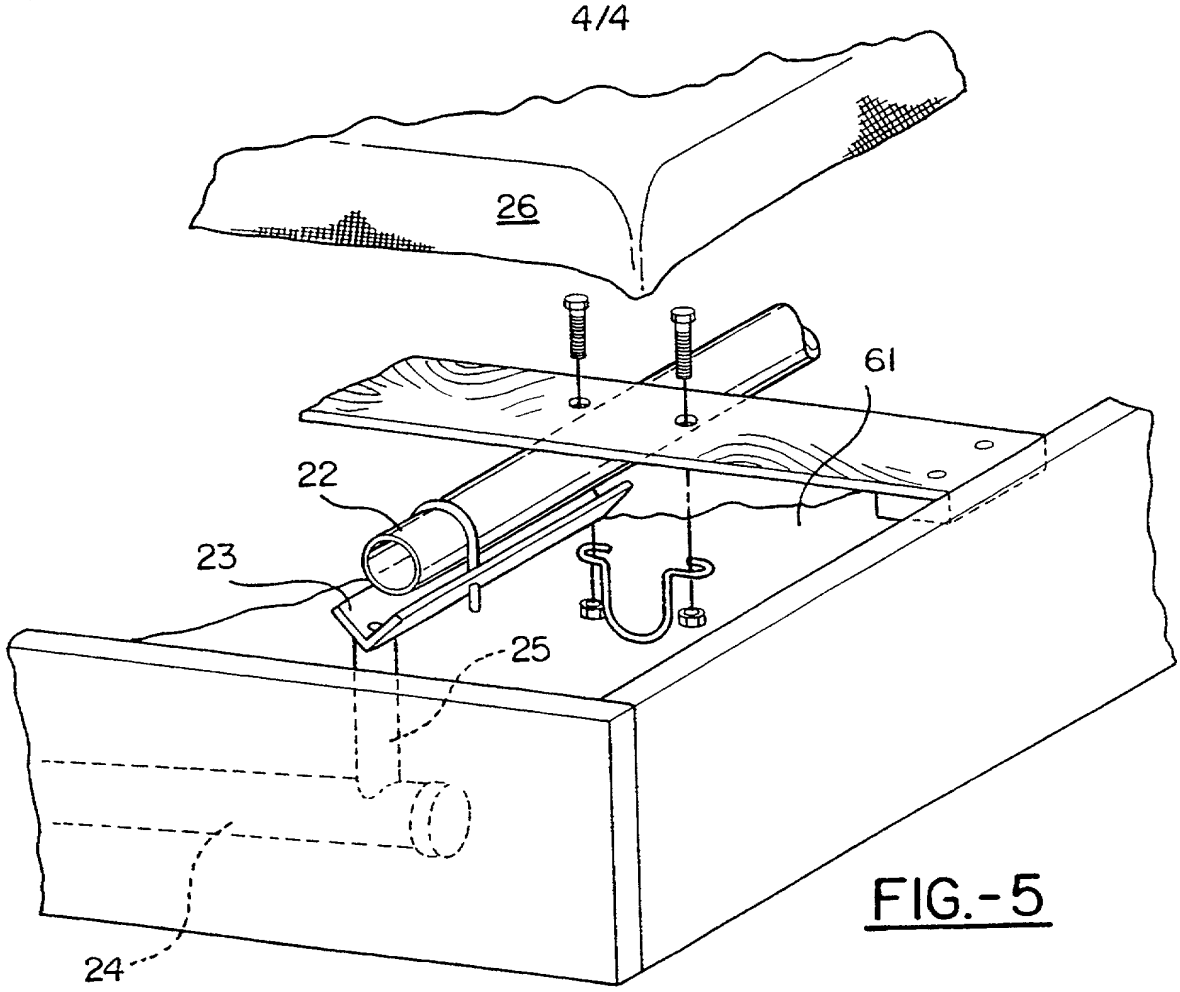

FIG.-5

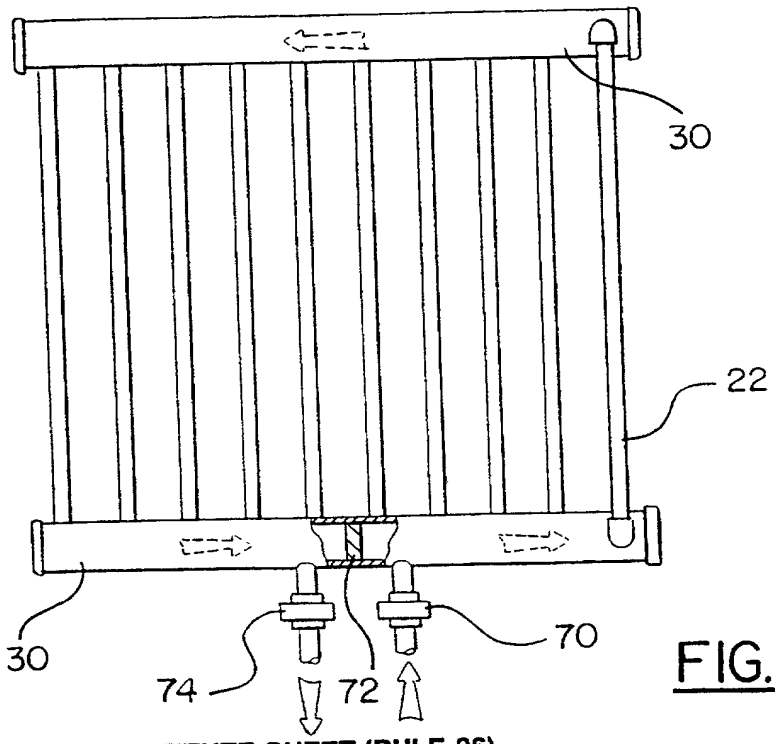

FIG.-6

Docket No.
American P-302

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

"WATER CONDENSATION SYSTEM"

the specification of which

(check one)

☐ is attached hereto.

☒ was filed on October 22, 1999 as United States Application No. or PCT International Application Number PCT/US99/24800

and was ~~amended~~ last amended on 20.11.00

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Not Claimed
(Number)	(Country)	(Day/Month/Year Filed)	☐
(Number)	(Country)	(Day/Month/Year Filed)	☐
(Number)	(Country)	(Day/Month/Year Filed)	☐

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

60/105,500	**23.10.98**
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

PCT/US99/24800	**22.10.99**	**Pending**
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

Lynn E. Cargill - Reg. 31,598
Susan M. Cornwall - Reg. 32,610
Mary H. Powell - Reg. 40,404

Send Correspondence to: **Lynn E. Cargill**
Cargill & Associates
56 Macomb Place
Mt. Clemens MI 48043

Direct Telephone Calls to: *(name and telephone number)*
Lynn E. Cargill - (810) 465-6600

Full name of sole or first inventor **William S. Malson**
Sole or first inventor's signature William S Malson — Date: Apr 23, 2001
Residence **17910 Greenfield, Clinton Township, MI 48038** MI
Citizenship **United States of America**
Post Office Address

Full name of second inventor, if any **Louis Rosberg**
Second inventor's signature Louis Rosberg — Date: 4-23-01
Residence **3079 Ravinewood Drive, Commerce Township, MI 48382** MI
Citizenship **United States of America**
Post Office Address